Images Description and Claims (79 Kb)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(11) WO 01/*11119* **(13)** A1

(21) PCT/GB00/02998

(22) 03 August 2000 (03.08.2000)

(25) English **(26)** English

(30) 9918376.6 05 August 1999 (05.08.1999) GB

(43) 15 February 2001 (15.02.2001)

(51)[7] **D01D 5/23**, 5/253, 5/098, D04H 3/00

(54) FILAMENT PRODUCTION METHOD AND APPARATUS

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(81) AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW

(84) ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG)

Published
-- *with international search report*

(57) A method of making spun bonded fabrics from filaments of polymeric material is disclosed. Conventionally, spun bonded fabrics are made by extruding a polymer in molten form out of apertures in a spinneret plate to produce filaments, drawing these filaments away from the spinneret plate, blowing a flow of cooling air transverse to the filaments as they are drawn away from the spinneret, depositing the filaments as they emerge from the drawing device on a conveyor to form a mat of the filaments, and effecting treatment on the mat to connect the individual filaments together to form a fabric. In the inventive method, the filaments are drawn at a speed of greater than 400 metres per minute away from the spinneret, the apertures in the spinneret are approximately C-shaped so that the cross sectional shape of the extruded filaments is approximately C-shaped, and the cooling air flow is directed towards the open mouth of the C shape of the filament cross section.

Description Claims

Filament Production Method and Apparats This invention relates to a method of and apparatus for producing fabrics of or including crimped polymeric filaments. Particularly, but not exclusively, the filaments are of polypropylene. Specifically, this invention relates to the production of so-called"spun bonded" fabrics, which require a pre-determined resilience, as they are used in the manufacture of carpets or floor coverings, filters and wipes, and hygiene and healthcare textile products, and the like.

Spun bonded fabrics are also used to produce clothing products which are required to provide warmth to a wearer, and which are required to have good draping qualities and/or flexibility. In some other cases, the fabric has to provide good acoustic qualities. The above shows that spun bonded fabrics can be used in a wide variety and almost infinite number of applications. The fabrics according to this invention can be used in any of these applications.

It is well-known to form a spun bonded fabric by melting a thermoplastics polymer material and then forcing the said melting polymer through a spinneret plate comprising one or more orifices to form filaments. The spinneret plate is disposed horizontally and the configuration of the extrusion apparatus is such that the filaments emerge and are drawn vertically downwardly therefrom.

The filaments issuing from the spinneret orifices are drawn away at high speed traditionally by air jets spaced apart from the spinneret and typically incorporating a venturi nozzle for accelerating the air, and thus the filaments, which also pass through the venturi device, to the desired velocities. This process is known as"draw down", and it is important to note that although air jets incorporating venturi nozzles are typically used, any high speed drawing device could be used, such as high speed rollers which could drag the filaments at high speed away from the spinneret orifices through which the filaments emerge.

On leaving the spinneret, the filaments are solidified by means of a wide, slow moving flow of air which may be directed from one or both sides of the filament. The cross current of air provides a cooling air environment which solidifies the molten polymer constituting the filaments, and in general this cross-current of air extends from the spinneret plate to the drawing device to ensure the complete solidification of polymer. Typically, this cooling of the filaments occurs over a vertical depth beneath the spinneret plate of between 2-4m and air flows through the vertically drawn filament bunch at a speed in the region of 0.5 m/s., The spinneret has a large number of apertures and it is usual to use a plurality of spinnerets arranged relative to one another such that filament bundles issuing from each of the spinnerets overlap to such an extent that a uniform filament web results.

The drawing device deposits the cooled filaments onto a moving conveyor, for example in the form of a mesh screen. The drawing device may be caused to oscillate which results in the laying down of a lapped mat of filaments on the conveyor.

By adjusting the linear speed of the conveyor, the thickness of the filament mat may be controlled. The denier of the filaments may be controlled by various means including controlling the rate at which the polymer is forced through the spinneret and the rate of drawing off of the filaments from the spinneret..

A number of methods are known to connect the randomly aligned filaments deposited on the conveyor into a stable textile-like fabric.

In a first known method, the mat of filaments is passed under pressure continuously between two or more calendar rolls.

Usually at least one of the calendar rolls is heated and has an embossed surface pattern consisting of raised diamond shapes in staggered rows. The filaments are not only connected, but the mat of filaments is compressed into a sheet material of thickness set by the gap, which is ADJUSTABLE, between the calendar rolls. The heated calendar roll with the embossed surface pattern co-operates against a cold calendar roller causing the filaments to be spot welded together at the pressure points created between the two calendar rollers creating the spun bonded fabric.

The second known method of connecting the filaments laid down on the conveyor is to pass the web of filaments through a barbed needle felting machine in order that the filaments in the web become entangled together such that they do not easily separate and thus define the spun bonded fabric..

Uses to which spun bonded fabrics have been successfully put include: surgical dressings, cover stock material for babies disposable nappies, hygienic products, geotextile re-enforcing materials, surgical gowns and hospital operating theatre sheets, agricultural sun screen fabrics, motorway, landfill, and drainage liner fabrics, air filtration fabrics, and hygiene textile products in general.

Whilst the spun bonded fabric process as described hereinabove has reached a very advanced state of development, there are some serious disadvantages in the material produced by the known methods. In particular, the materials lack the aesthetics of traditional woven or knitted textile materials such as drape, three dimensional flexibility, softness and resilience (springiness). In addition, they are often are stiff and in this respect they often have a flexibility feel similar to a sheet of thick cardboard, which has a limiting effect on the use of the spun bonded fabrics.

The disadvantages mentioned hereinabove we believe are predominantly due to the fact that in the methods described hereinabove, the resulting filaments are basically straight or in other words have little or no crimp (which improves the bulk of the filament and hence many qualities such as flexibility and drape of fabrics using such filaments).

It is not possible to apply crimp the filaments either between spinneret and the drawing device and the drawing device and the conveyor due to the speed of operation and mechanical limitations, and this invention seeks to provide a method and apparatus by which self crimp may be induced into the filaments, so that an improved spun bonded fabric will result.

One can achieve self-crimping of filaments by extruding simultaneously filament of two different polymers (bi-polymer method) with the different polymers being arranged in side by side relationship as they leave the spinneret orifices. Crimp results from the different characteristics of the two polymers which make up each filament as the filament is cooled or cools.

The two polymers used obviously are required to have dissimilar properties, and by careful choice of the two polymers, a self- crimping filament may result.

Whilst this process is well-known, and well developed, it clearly suffers from a disadvantage of requiring very expensive spinneret technology, two extruders to melt the two polymers, and a spin beam arrangement which is complicated and expensive.

A further disadvantage of this known method of producing self- crimped fibres is the very high up keep costs of the SPECIALISED apparatus required to form the filaments.

It is known to use, for the production of self crimping filaments and staple fibre, spinnerets in which the apertures are of other than circular cross section.

There has not been provided however, a method of producing spun bonded fabrics from polymeric material of which the running conditions have been identified such that reliably spun bonded fabrics with greatly enhanced properties of drape, bulk flexibility comparable with those achieved by the"bi-polymer"method mentioned above, without the disadvantages of the"bi-polymer" method, can be produced.

According to the present invention there is provided a method of making spun bonded fabrics from or including filaments of polymeric material, comprising the steps of a) extruding the polymer in molten form out of apertures in a spinneret plate to produce filaments b) drawing the filaments from the spinneret plate by means of a drawing device c) blowing a flow of cooling air in the form of a sheet from an air knife transverse to the filaments as they pass from the spinneret to the drawing device d) depositing the filaments as they emerge from the drawing device on a conveyor to form a mat of the filaments, and e) effecting treatment on the mat to connect the individual filaments together to form a fabric, characterised in that F) (I) the filaments are drawn from the spinneret so that at the drawing device, the filaments are travelling at a speed of at least 400 metres per minute, (II) the apertures in the spinneret are of a cross section which comprises or approximates a C-shape to extrude, at the spinneret plate, filaments of the same cross sectional shape, and (iii) the cooling air flow is towards the open mouth of the C shape of the filament cross section.

Producing spun bonded fabrics by this method has resulted in filaments which self crimp as soon as the tension thereon is released as the filaments exit from the drawing device and are placed on the conveyor. Also, subsequent heating of the fabric seems to enhance the crimp of the individual filaments, and the resulting fabrics have excellent bulk, drape and flexibility.

Preferably the air flow is at a rate in the order of between 3m/s and 30m/s, and most preferably between 3 and 10 m/s and the depth of the sheet is preferably less than 500mm, but this will to some extend depend upon the filament bundle being extruded and sheet depths of more than 500mm may be required. The air knife is preferably disposed immediately below the exit face of the spinneret from which the filaments exit the apertures.

Most preferably the air flow is of a depth of 50mm.

With reference to the cross sectional shape of the apertures, by C- shape or substantial C-shape is meant any shape which has a majour peripheral portion between the ends of which is an inwardly directe mouth. For example a square, rectangular or circular shape with a quadrant or any regular or irregular shape with a single portion removed to define a mouth would approximate a C-shape in accordance with this invention.

It has been found that directing the air flow towards the mouth of the C-shape is significant in causing the filaments to self crimp. The flow can be directed directly at the mouth, but with the specific shape of aperture we prefer, best results have been obtained by directing the air flow at one side of the mouth, as explained more fully herein.

In the preferred embodiment, the at least one orifice comprises: a first portion having a first transverse cross-section defining a discontinuous loop, wherein the loop substantially surrounds a solid portion of a spinneret plate; and a second portion having a second transverse cross-section defining a continuous loop corresponding substantially the discontinuous loop of the first portion, wherein molten thermoplastic plastics material is passed in use through the at least one orifice in a direction from the first portion to the second portion.

By means of the present invention, fabrics of highly crimped, specifically helical three-dimensionally crimped filaments, have been produced without having to resort to the use of bi-polymer filaments or additional mechanical treatments such as stretching or mechanical crimping.

By providing three-dimensional highly crimped filaments in a spun bonded fabric, the physical properties and feel of the final fabric are greatly changed and improved. For example, the fabric has draping properties rather than being stiff, and is flexible. The fabric has greater warmth through air entrapment within the crimped filament structure. The loft, resiliency and springiness of the fabric is also be greatly improved.

It has been found that the filaments must be drawn from the spinneret plate (where they are moving quite slowly) so as to reach a speed at least in the order of 400 metres per minute. Any less draw down results in little or no self crimping of the filaments. The upper limit of draw down speed is a practical one in that if the speed of draw down is too high then the filaments simply break, which of course is unacceptable.

Advantageously, the method further comprises a step of heat setting the self-crimped filaments. This ensures that the helical crimp in the filaments is made substantially permanent.

The heat treatment takes place immediately after the spinning step, which is after the filaments have passed through the drawing device.

Most preferably, there is an air suction means disposed at the opposite side of the spinneret plate to that on which the air knife is disposed. The addition of a suction means helps to maintain the uniformity of the air flow through the filaments and to restrict the depth of air flow to the depth of the air knife outlet from which the flow emerges. Additionally, the suction means assists in the drawing of the air through the filaments, and ensures that the velocity of air through the filaments does not decrease significantly.

Also according to the invention there is provided apparatus for making spun bonded fabrics from or including filaments of polymeric material, comprising G) a spinneret plate for extruding the polymer in molten form out of the apertures in the spinneret plate to produce filaments h) a device arranged to draw the filaments from the spinneret plate i) an air knife arranged to blow a flow of cooling air in the form of a sheet transverse to the filaments as they pass from the spinneret to the drawing device j) a conveyor arranged to have the filaments deposited thereon as they emerge from the drawing device to form a mat of the filaments on the conveyor, and k) means for effecting treatment on the mat to connect the individual filaments together to form a fabric, characterised in that 1) (i) the drawing device is such at to cause the filaments to be travelling at a speed of at least 400 metres per minute at the drawing device, (ii) the apertures in the spinneret are of a cross section which comprises or approximates a C-shape to extrude, at the spinneret plate, filaments of the same cross sectional shape, and (III) the air knife is arranged to direct the cooling air flow towards the open mouth of the C shape of the filament cross section The invention will now be further described by way of example only with reference to the accompanying drawings in which: Figure 1 is a schematic representation of an apparatus for forming spun-bonded fabrics according to a first embodiment of the invention; Figure 2 is a schematic representation of an apparatus for forming spun-bonded fabrics according to another embodiment of the invention; Figure 3 is a schematic representation of a preferred shape cross section for the apertures in the spinneret plates of the embodiments of the invention shown in Figs. 1 and 2; and Figure 4 is a schematic representation showing various examples of spinneret aperture shape which may be adopted for this invention to show how different these shapes might be.

Similar parts in the two apparatus shown in Figures 1 and 2 have been given corresponding reference numerals.

Referring to Figure 1, an apparatus for forming spun bonded fabric according to the invention is designated generally by the reference numeral 1. The apparatus comprises an extruder 2 for extruding polymer which is introduced into the apparatus via hopper 3 and fed into the spinneret via filter 4, gear pump 5 and spin beam 6. The extruded polymer is forced through apertures (also referred to herein as orifices) in the spinneret 7 and is then subject to

a cross current of air in the form of a sheet of air flow produced by air knife 8. The cross current of air provides a rapid cooling air environment. There is an air suction means 8A, for example in the form of a duct in which a vacuum is created, disposed at the opposite side of the spinneret plate to that on which the air knife is disposed. The addition of a suction means helps to maintain the uniformity of the air flow through the filaments and to restrict the depth of air flow to the depth of the air knife outlet from which the flow emerges. Additionally, the suction means 8A assists in the drawing of the air through the filaments, and ensures that the velocity of air through the filaments does not decrease SIGNIFICANTLY.

The filaments issuing from the spinneret orifices are drawn away at high speed by a drawing device in the form of air jet 9 positioned some distance away from the spinneret. The air jet 9 blows the cool filament onto a moving conveyor in the from of mesh belt 10 where the filaments 11 are collected. The drawing speed is such that the filaments as they travel through the air jet 9 are moving at least at a speed of 400 metres per minute.

Due to the high speed of drawing away and stretching of the filaments of molten polymer issuing from the spinneret, a very high degree of orientation is induced into the molecular structure of the filaments as they are rapidly cooled. It is believed that the degree of orientation contributes to the self-crimping of the filaments (along with other features) as described hereinafter.

The filaments are deposited onto the moving mesh belt 10 in a randomly aligned mat or web 11.

The filaments are consolidated into a stable textile-like fabric by passing the randomly aligned web through two or more calendar rolls 12 which form a bonder. One but preferably each of the calendar rolls is heated and has an embossed surface pattern. The web of filaments 11 is compressed in thickness into a sheet material 13. The thickness of the sheet material is related to the thickness of the mat entering the bonder and the bond area of the patterned roll and preferably the gap between the calendar rolls 12,14 is fixed to maintain a fixed bonding pressure..

The mat, before it enters the bonder is preferably subjected to pre heating at station S to effect pre-shrink of the fibres if necessary.

Referring to Figure 2, similar parts of the apparatus have been given corresponding reference numerals.

In Figure 2, the randomly aligned web of filaments 11 is consolidated by passing the web through a barbed needle felting machine 20 in order that the filaments 11 in the web become entangled together such that they do not easily separate and thus become useful as a textile-like material 22.

By making the filaments as described, along with the other features described herein, the filaments as they leave the air jet 9 show a propensity to self crimp to a high degree, and as a result the fabric 13 or 22 which results from the process, has excellent qualities of bulk, drape and flexibility, and is excellent for the various uses of spun bonded fabric as described herein.

An important feature of the invention is the shape of the orifices in the spinneret plate, and in this connection reference is now made to Fig. 3.

Referring to Figure 3, a typical orifice having a non-circular cross- section which comprises a full circular cross-section with one quarter of a circle removed is shown. A spinneret with orifices with this shape is particularly effective in the method of the invention.

Also of importance is the direction in which the air flow passes over the filaments as the emerge from the spinneret exit face. The air flow should be into the mouth M of the cross section of the filaments. This flow can be in the direction of middle of the mouth, but best results have been obtained by blowing the air into the edge of the mouth as indicated by arrows A, where the air flow is tangential to the face 33. As the filament is drawn down, so its cross sectional shape will change, and so it is best if the air flow is applied as soon after the filaments emerge from the spinneret plate as possible.

This particular orifice shape can be described in more general terms as having an arcuate peripheral portion 31 and two rectilinear portions 32,33. An orifice shape being a full circle (as shown in the dotted lines) would have a geometric centre at 34, but in the case of the orifice shape shown in Figure 3, the geometric centre will move to a position approximately at 35. The rectilinear portions 32,33 of the shape 30 therefore approach and recede from the geometric centre 35 in a particular angular sector defined by the dotted lines 36,37. Ideally the base angle 0&#x0;OUF this sector is 90°, but different angles may be selected. The orifice cross section in any event approximates a C shape, and the invention requires that the orifice has a C shape or an approximate C-shape, again for reasons given below.

The C shape can be an exact shape as shown in Fig. 4 (a), or it may be of quite a different form to approximate a C shape as indicated in the other parts of Fig. 4. In each case, the approximate shape of the C is indicated by the dotted line X, and the mouth is indicated by the letter M.

Normally, the spinneret orifice extends through the spinneret plate at right angles to the plate exit face, but this is not necessary and the orifice could pass through the plate at an angle.

It should be mentioned that the spun bonded fabric may be produced without being calendared or needled as described above.

Also, in order to create a spun-bonded web of material of much greater width than the width of the spinneret plate from which the filaments emerge, a cross-lapping machine (not shown) may additionally be provided immediately after the air jets 9. Said machine oscillates laterally of a translating belt, such as the mesh belt 10 shown in the Figures and thus a web of gossamer-like crimped filaments may be laid on such a belt from side to side at a uniform thickness and subsequently needled, calendared or otherwise processed to connect the filaments into a fabric. In this manner, it may be possible to cross-lap a number of differently coloured webs of self-crimping filaments and subsequently needle all said cross-lapped webs together to produce a carpet-like material with a predetermined pattern. This method of producing carpet fabric has great advantages over conventional methods in that a carpet material can be produced quickly without the requirement for a large number of additional process steps.

It should also be mentioned that the spun bonded fabrics produced according to the invention can be effectively needled whereas the needling of filaments crimped by more conventional methods often results in the tearing and breakage of the filaments. This results from the improved resiliency and elasticity properties possessed by the self-crimping filaments.

The invention will now be further described by way of the following five examples: Example 1 A polypropylene resin manufactured by Montell of grade no. TM 6100 having a MFI (Melt Flow Index) of 18 was charged into a 1"laboratory thermoplastic Extruder fitted with a spinneret head into which could be inserted different spinnerets. The spinneret was drilled with a total of 3 rows x 20 COLUMNS = 60 holes each having a diameter of 0.8mm and shown in Figure 3.

The head and spinneret pointed in a downwards direction and was so arranged that a cross blowing blast of cooling air could play on the molten filaments as they emerged from the

spinneret face. The extruder was set with a temperature profile of 190-220°C and the spinneret and head were maintained at a temperature of 205°C.

Some distance away but directly in line with the spinneret was a suction device of the type sold on the UK market under the trade name"Airmover". By connecting a supply of high pressure compressed air to this device a venturi effect is created which enables the filaments issuing from the spinneret face to be sucked away at a high speed. By ADJUSTING the volume and pressure of compressed air supplied to this"Airmover"the spinning speed of the filaments could be adjusted. Immediately following the Airmover a filament porcelain guide was positioned so that the filament bundle could be collected together and lead away to a precision filament take up winder which was situated nearby. The take up winder was fitted with an askew filament advancing roller so that several wraps of the filament bundle could be taken around it to give a positive traction to the filaments. The askew rollers were fitted with a tachometer calibrated in metres per minute so that the precise speed of spinning or draw off could be ascertained.

The charged extruder was started and molten filaments soon emerged from the face of the spinneret which was of the type that creates a stress differential across the diameter of the orifice. The filaments were cooled by applying a stream of cooling air provided by a fan arrangement. The air was at a temperature of 14°C. The cooling filaments were drawn away by the air mover and then passed via the ceramic thread guide to the askew rollers of the precision take up winder, maintained at a speed of 250 metres per minute and collected as a bundle.

The extruder was adjusted for output so that the final filaments had a denier of 5 per filament (9000 metres of a single filament weighed 5 grams).

The filaments which had not undergone any stretching or drawing process, other than melt draw down were unwound from the collecting bobbin of the winder and were measured in an Instron tensiometer and found to have a tenacity of 2.6 grams per denier with an elongation at break of 60%. Such filament properties are ideal for many textile applications. As the filaments were unwound from the collecting bobbin where they were under a high tension they were seen to have a straight appearance with no crimp present.

However, within a few seconds of the winding tension being removed the filaments formed into tight helical crimps. A 90 metre hank of the 60 filament yarn was wound off the take up bobbin on a textile hank winder. The arms of the hank winder swift were collapsed to allow the removal of the hank and immediately the filaments self crimped into a helical crimp formation. These crimped filaments were stressed by hand to virtually their breaking point and then the tension was released. The degree of crimp in the filaments increased and could not be removed by applying high tension. Next a group of filaments were stressed to breaking point but when the broken filaments were examined none of the crimps had been removed and were measured to have increased in frequency.

A further 90 metres length hank of filaments was prepared on the swift of the hank winder and removed. on removal, the filaments again reverted into a helical crimp formation. This hank of filaments was then placed in a hot air circulating oven maintained at a temperature of 130°C for a period of three minutes. on removal from the oven the helical crimp of the filaments had not been removed but was even more pronounced.

The length of the hank was again measured and found to be 80 metres i. e. the hank had shrunk in length by 10 metres due to the heat setting step.

The crimp percent of the heat set filaments was determined to be 60%. Crimp % is defined as: [(ORIGINAL LENGTH OF TENSIONED FILAMENTS)- (LENGTH of Untensioned filaments)] xlOO Original Length of Tensioned filaments This is a very high degree of

permanent crimp and is very suitable for large number of textile end products.

Example No. 2 The example of No. 1 was repeated but instead of diverting the filament bundle by means of a ceramic thread guide to a take up winder as in experiment 1, the filament array issuing from the air mover was blown directly onto a sheet of perforated metal held 30 centimetres away from the discharge end of the Airmover Nozzle.

The perforations in the plate allowed the conveying air stream carrying the filaments to pass through the plate but the filaments were deposited on the surface of the perforated sheet. The sheet of perforated metal was oscillated by hand and an even batt of filaments allowed to built up thereon. It was noticed that immediately the filament array was released from the discharge end of the Airmover they became un-tensioned and the filaments became very voluminous and spontaneously self crimped into a tight helical crimp formation.

A stream of heated air (130°C) was blown onto the filaments resting on the perforated plate to heat set the filaments and further develop the helical crimp. The batt of highly crimped filaments was a very suitable material to convert into a textile product either by needling with felting needles, or by consolidating BY means of an embossed heated calendar rolls.

Example No. 3 Example No. 1 was repeated, but the spinneret plate in the extruder was changed for one in which the orifices were arranged to pass through the spinneret plate and an angle, in this case at 45 degees.

This spinneret plate had the same number of holes and shape as that shown in Fig 3 with the except that the holes were drilled at an angle of 45° TO the exit surface of the spinneret.

On examination the filaments produced by this experiment were even more highly crimped than those produced by Experiment No.

1.

Example No. 4 Example No. 1 was again repeated in all respects with the exception that the polypropylene resin was changed to a grade type XS 6500 made by Montell. This grade is narrow molecular weight distribution polymer with a melt flow index of 35. The resulting filaments crimped spontaneously on become tensionless after exiting from the Airmover used to draw the filaments away from the spinneret.

Example No. 5 Example No. 1 was again repeated in all respects with the exception that the polypropylene resin was changed to a grade type VS 6100 made by Montell. This grade is a narrow molecular weight distribution polymer with a melt flow index of 25. The resulting filaments crimped spontaneously on become tensionless after exiting from the Airmover used to draw the filaments away from the spinneret. On heat setting the filaments the helical crimp further increased and was of a permanent nature which could only be removed by heat setting under high tension at a temperature which was substantially higher than the 130°C used to heat set the crimps into the filaments.

By varying the cross sectional area of the spinneret orifices and the spinning speeds employed together with the type of polypropylene resin, extrusion temperature, cooling rate and spinning a large variety of self crimping filament deniers may be made by the method described above. These self crimped filaments may advantageously be converted to spun bonded fabrics as described hereinabove the result that the end product is considerably improved in terms of resiliency, drape, handle, softness, springiness. warmth and sound insulating properties together with a much higher aesthetic textile appearance.

Description Claims

CLAIMS 1 A method of making spun bonded fabrics from or including filaments of polymeric material, comprising the steps of a) extruding the polymer in molten form out of apertures in a spinneret plate to produce filaments b) drawing the filaments from the spinneret plate by means of a drawing device c) blowing a flow of cooling air in the form of a sheet from an air knife transverse to the filaments as they pass from the spinneret to the drawing device d) depositing the filaments as they emerge from the drawing device on a conveyor to form a mat of the filaments, and e) effecting treatment on the mat to connect the individual filaments together to form a fabric, characterised in that (I) the filaments are drawn from the spinneret so that at the drawing device, the filaments are travelling at a speed of at least 400 metres per minute, (ii) the apertures in the spinneret are of a cross section which comprises or approximates a C-shape to extrude, at the spinneret plate, filaments of the same cross sectional shape, and (iii) the cooling air flow is towards the open mouth of the C shape of the filament cross section.

2. A method according to claim 1 wherein the air flow is at as speed in the region of 3 to 30 metres per second.

3. A method according to claim 1 or 2, wherein the air flow sheet is of a depth of 10 to 75 mm.

4. A method according to claim 1,2 or 3, wherein the apertures in the spinneret plate are of a cross sectional shape comprising a circle with one quarter removed.

5. A method according to any preceding claim wherein the cooling air flow is towards one side of the open mouth of the C shape of the filament cross section.

6. A method according to any preceding claim, wherein the connecting of the filaments includes the application of heat.

7. A method according to any one of the preceding claims, wherein the connecting of the filaments includes mechanical processing.

8. A method according to claim 7 wherein the mechanical processing includes needling.

9. A method according to any preceding claim including the step of pre-heating the fibres between the steps of drawing the filaments and the effecting the treatment on the filaments to form the fabric.

10. Spun bonded fabrics produced by the method of any one of the preceding claims.

11. Apparatus for making spun bonded fabrics from or including filaments of polymeric material, comprising a) a spinneret plate for extruding the polymer in molten form out of the apertures in the spinneret plate to produce filaments b) a device arranged to draw the filaments from the spinneret plate c) an air knife arranged to blow a flow of cooling air in the form of a sheet transverse to the filaments as they pass from the spinneret to the drawing device d) a conveyor arranged to have the filaments deposited thereon as they emerge from the drawing device to form a mat of the filaments on the conveyor, and e) means for effecting treatment on the mat to connect the individual filaments together to form a fabric, characterised in that f) (i) the drawing device is such at to cause the filaments to be travelling at a speed of at least 400 metres per minute at the drawing device, (ii) the apertures in the spinneret are of a cross section which comprises or approximates a C-shape to extrude, at the spinneret plate, filaments of the same cross sectional shape, and (iii) the air knife is arranged to direct the cooling air flow towards the open mouth of the C shape of the filament cross section

Description Claims